

RETROPERITONEAL PERIRENAL LIPOMATA.

A STUDY OF LARGE RETROPERITONEAL LIPOMATA OF PERIRENAL ORIGIN. THE TECHNIQUE OF THEIR REMOVAL, BASED ON ANATOMICAL STUDIES, WITH THE REPORT OF A CASE.

BY EDWARD REYNOLDS, M.D., and RICHARD G. WADSWORTH, M.D.,

OF BOSTON, MASS.

RETROPERITONEAL LIPOMATA are tumors which usually attain a very large size before being called to the attention of the surgeon. They are often of obscure origin, though the majority probably arise from the perirenal fat. They are so rare that it seldom happens that any surgeon sees more than one, and it is probably for this reason that no definite technical principles for their removal have been evolved and recognized. This fact, together with the high mortality hitherto incurred, makes it important that every case should be carefully studied and reported in detail. This is the more important as it is probable that the absence of a recognized technique has been responsible for the not infrequent cases of incomplete removal. Several surgeons have recognized the advantages of an attack by enucleation from within the capsule, which was the method that led to success in the case to be reported; no one, however, has made any attempt to describe the relations of the capsule to the anatomical dangers within and without it, or to lay down guides for their avoidance.

It is a belief in the importance of attaining definite knowledge on this subject that has led us to the anatomical study of these relations which is the basis of this article.

Adami in 1897 collected 42 cases of retroperitoneal lipoma in the literature and classified them according to origin, making three classes, viz: (1) Those definitely perirenal, (2) those of doubtful origin, and (3) those arising from the mesenteric

fat. The most recent, comprehensive article on this subject which we have been able to find was published by Johnson in 1904. He considered 24 of Adami's cases to be of perirenal origin and thought that probably many of the doubtful cases also belonged in this class, so that it may perhaps be considered that rather more than fifty per cent. of retroperitoneal lipomata arise from the perirenal fat. He was able in 1904 to collect only 46 cases in the literature, and at that time reported two more of his own, which with the case reported here brings the total up to 49.¹ That these growths are essentially benign is shown by the fact that in only three of these cases has sarcomatous degeneration been found, and that the growth has recurred after removal in only one case. They must, therefore, be considered as distinct from retroperitoneal sarcomata, which may, however, present a very similar clinical picture.

The symptoms connected with these growths are chiefly conspicuous by their absence. Usually the first symptom is a feeling of weight in the abdomen with some gastric irritability. As the tumor grows the symptoms are those of pressure, such as alternate constipation and diarrhoea accompanied by vomiting, dyspnoea, œdema and ascites from venous obstruction, and occasionally neuralgic pains in the legs from pressure on the lumbar plexus. But it is extraordinary how often only trifling symptoms are present, even when the tumor has reached a very large size.

The diagnosis is made by the lack of mobility, the smooth rounded surface, and the semi-fluctuant sensation imparted by the fat, aided occasionally by the stripe of tympany in the middle of the flatness over the rest of the tumor which is made by the overlying colon when that is distended; but the diagnosis has been very infrequently made, the tumor being most often mistaken for an ovarian cyst. Other mistaken diagnoses have been those of mesenteric and retroperitoneal cysts,

¹ Since this was written Dr. Ahren, of Quebec, has reported a case (Bull. Med. de Quebec 1905-6, vii, pp. 1-6), making a total of fifty cases reported and known to us.

echinococcus cyst of the liver, hydronephrosis, and even ascites.

The treatment is necessarily operative. Of the 49 cases reported, 31 have been operated on, with a mortality of 48.4 per cent., one recurrence increasing the mortality to 51.6 per cent., the remainder having been seen post mortem. An analysis of the cause of this very high operative mortality strongly emphasizes the desirability of an accurate anatomical knowledge of the conditions which are likely to be encountered.

The three dangers of the operation as deduced from the fatal cases are: accidental injury of the mesenteric vessels, necessitating resection of the bowel; accidental injury of the vena cava or its other branches; and death from shock, which must be greatly influenced by slow operating or the time necessarily spent in the repair of such accidental injuries, all of which would be minimized by a more accurate knowledge of the anatomy of the tumor, and by this only.

In the course of this case and in subsequent conversation about it, it became evident to us, first, that its success had rested upon following the inner surface of the capsule as a guide, and, second, that this capsule was the distended perirenal fascia. This perirenal fascia has been described repeatedly in the last few years, but always in connection with its function of contributing to the support of the kidneys through its limitation of the perirenal fat. In these dissections no study of its relations to the vessels and viscera in contact with its outer surface was reported, but these relations are the essential anatomical points in the removal of these tumors, and this was the reason for our institution of fresh dissections.

Although our present knowledge of the perirenal fascia is founded really on the work of Gerota in 1895, the existence of a fascial capsule about the perirenal fat had been recognized by many investigators before that time and with gradually increasing clearness of description.

In 1883 Zuckerkandl described a well-marked fascia lying between the quadratus lumborum muscle and the fatty capsule of the kidney. This he considered to be the continuation of the

subperitoneal fascia of the anterior and lateral abdominal wall. Tracing it inward he described it as becoming attached to the capsule of the kidney at its inner margin. In front of the kidney he recognized a thin fascial layer between the perirenal fat and the parietal peritoneum, which in some subjects was condensed to such an extent as to form a distinct lamella of some density. In 1889 Sappey, while recognizing the posterior layer as Zuckerkandl had described it, gave more importance to the anterior layer, which according to his investigations extended inward to become attached to the inner border of the kidney. A year later Charpy described an offshoot from this anterior layer at its attachment to the hilus of the kidney, which passed across the middle line immediately in front of the renal vessels, aorta, and vena cava to join its fellow of the other side. The retrorenal and prerenal layers were at this time described as uniting at the upper pole of the kidney, thus separating the suprarenal capsule from the kidney.

With Gerota's work, however, our knowledge of the fascia becomes more exact. In 1895 he published the results of a protracted study of this whole region by means of micro- and macroscopical examination of sections of embryos, infants and adults. His description of the perirenal fascia is as follows:

The prerenal and retrorenal layers are formed by the splitting of the subperitoneal fascia of the abdominal wall at the outer border of the kidney.

The retrorenal layer passes inward between the perirenal fat in front and the fascia covering the anterior surfaces of the quadratus lumborum muscle and its aponeurosis and the psoas magnus muscle behind. At the inner border of the psoas magnus it blends with the fascia covering the bodies of the lumbar vertebræ and the intervertebral disks.

The anterior or prerenal layer passes in front of the perirenal fat between it and the peritoneum and is continued inward just in front of the renal vessels, aorta, and vena cava to join the corresponding layer of the other side. Both the anterior and posterior layers are attached to the kidney capsule

by fine fibrous bands which pass through the perirenal fat, but the fasciæ as such have no direct attachment to the kidney. The retrorenal layer extends upward in front of the diaphragm and behind the kidney and suprarenal capsule, at the upper border of which it is joined by the prerenal layer from in front of them, the two becoming lost in the diaphragm. Below the kidney the two layers approach each other but do not actually join and, becoming thinner and thinner, are lost in the loose areolar tissue of the iliac fossa.

This fascia of Gerota, then, forms a fascial compartment, closed above and externally, but open below and internally, in which is contained the kidney and suprarenal capsule and the perirenal fat. This compartment we shall refer to hereafter as the perirenal space.

As has been already said, the perirenal fascia has hitherto been studied only in connection with the supports of the kidney. Its relations to tumors arising from the perirenal fat has not been recognized and it is towards the elucidation of these relations that our own anatomical work has been especially directed.

This work (by Dr. Wadsworth) was made possible by the courtesy of Professor Dwight, who placed at our disposal all the material of the anatomical department of the Harvard Medical School. His kindly interest and many valuable suggestions have been of the greatest help.

Two sets of frozen sections of the adult abdomen were available, but both had been made several years before and had been more or less injured by much handling. In only one section was anything corresponding to the prerenal fascia made out. This consisted of a layer of tissue of some density lying between the parietal peritoneum and the perirenal fat on each side and continuous across the middle line just in front of the great vessels. This, however, could be traced only a short distance into the thickness of the section, and nothing corresponding to it could be found in the adjoining sections. A fresh set of adult sections could not be made, owing to lack of

material, and although a new-born infant was sectioned no trace of the perirenal fascia could be found.

The subjects which were available for dissection were being used by students in the regular anatomical courses, so that it was imperative that the abdominal contents should be as little disturbed as possible. It was, therefore, impossible to employ the method used by Koffman,—*i.e.*, the injection under the prerenal fascia of a material which would harden *in situ*. Similar injections of air and water were tried and proved ineffective, but satisfactory results were obtained by blunt dissection in the planes of cleavage with the finger and knife-handle. Three subjects were dissected in this way.

In each case an incision just large enough to admit the finger was made through the peritoneum overlying the left kidney and carried downward through the very scant perirenal fat to the fibrous capsule of the kidney, which was recognized by incising and stripping it from the kidney for a short distance. The kidney having been recognized in this way, the finger was withdrawn a little and gently pushed inward just in front of the perirenal fat. A distinct line of cleavage was at once recognized and was followed with very little difficulty to and beyond the median line, the finger passing immediately in front of, first, the anterior surface of the kidney and, second, the left renal vein as far as the vena cava. The tissues lifted away by this process consisted of two distinct layers, which could be made to move on each other when handled from within and without at the same time with the thumb and finger, the outer layer being the parietal peritoneum and the other the prerenal fascia.

Following the line of cleavage further to the right and across the median line, the finger passed behind the duodenum and then the ascending colon and immediately in front of the right renal vein and anterior surface of the right kidney. Here as on the left side, there were two distinct layers in front of the finger, the parietal peritoneum and the prerenal fascia. By separating these two layers from each other, it was seen that

the peritoneum passed over the anterior surface of the duodenum, while the prerenal fascia passed not only behind it but also behind the main trunk of the superior mesenteric artery, as it passed downward into the mesentery of the small intestine.

Carrying the dissection downward and outward from the original incision on the left side, the finger passed behind the descending colon. Here the peritoneum was seen to pass over the anterior surface of the colon, while the prerenal fascia lay behind it and appeared again in apposition with the peritoneum in the flank external to the colon. A similar arrangement was demonstrated on the right side in relation to the ascending colon.

Carrying the dissection inward from each side at and below the level of the lower part of the kidneys, the prerenal fascia was seen to extend across the middle line nearly as far downward as the bifurcation of the aorta, getting, however, thinner and thinner until it could be no longer made out. It thus passes directly behind the root of the mesentery of the small intestine, shutting off the mesentery and its vessels from the perirenal space.

The prerenal fascia was traced upward in front of the two kidneys only far enough to show that it passed across the base of the transverse mesocolon, thus shutting off this also from the perirenal space. In the middle line it was seen to pass beneath the pancreas, but was not traced further owing to the difficulty of seeing what one was doing, as nothing could be removed to make room. No attempt was made to trace the prerenal fascia to its lateral origin in the subperitoneal fascia of the abdominal wall, as this did not seem to be of particular importance to the object in hand.

To sum up the anatomy: The perirenal space, in which is contained the perirenal fat and to which a tumor growing from this fat must be limited, is bounded in front by the prerenal fascia, as just described, and behind by the retrorenal fascia described by Gerota.

The retrorenal fascia lies behind the perirenal fat, kidneys,

ureter, and renal vessels in direct apposition to the posterior abdominal wall on either side of the vertebral column. It therefore really forms a part of the posterior abdominal wall and is of no particular surgical importance.

The prerenal fascia, on the other hand, lies in front of the perirenal fat, kidneys, ureter, and renal vessels, and is of extreme surgical importance since it separates these organs from the other vital structures in the immediate neighborhood.

It is now important to consider the relations of this all-important prerenal fascia to the organs behind and in front of it; which are the intestines and their vessels in front, and the aorta, vena cava, and urinary organs behind it and therefore within the perirenal space.

The three parts of the colon, the entire small intestine, and the pancreas lies in close relation to the prerenal fascia, but outside it, and therefore are separated by it from the fat of the lipoma. An operation conducted within the perirenal space can therefore do no harm to the intestines unless by interference with their blood-vessels. The superior and inferior mesenteric arteries, which form their blood supply, are throughout their course also in front of the prerenal fascia except for a short distance after their origin from the aorta, when they must of necessity cross the perirenal space to penetrate the fascia. They are therefore liable to injury from an operation within the perirenal space only during the removal of the fat from the region of the aorta and vena cava in the median line.

The spermatic or ovarian vessels like the mesenteric arteries lie throughout their course in front of the prerenal fascia except for a short distance after their origin, when they too must pass through the perirenal space before piercing the fascia. They too are liable to injury only during the same portion of such an operation. The left ovarian (or spermatic) vein empties into the left renal and this must be remembered in dealing with the renal vessels.

The renal vessels extend in approximately straight lines between the kidneys and the aorta and vena cava. The kidney

necessarily lies in the middle of the perirenal fat and the renal vessels must therefore pass through the substance of these lipomata in order to reach their destination, but from the nature of the perirenal fat they must inevitably lie throughout between the lobules of the lipoma.

In the normal cadaver, the ureter lies throughout its abdominal course behind the prerenal fascia and within the perirenal space; immediately below the level of the kidney the prerenal and retrorenal layers lie close together with the ureter between them, but the ureter is more adherent to the prerenal than to the retrorenal fascia; the upper end of the ureter lies, however, between the lobules of the perirenal fat.

In the presence of a lipoma, it is evident that the upper end of the ureter must be completely surrounded by the substance of the growth. What the relations of the lower part of the ureter to the tumor will be cannot be foretold with accuracy, since they will probably vary in individual cases; from its closer attachment to the prerenal fascia it may, however, be stated with a fair degree of probability that it will always be found in relation to the inner or median half of the tumor, either lying among its lobules, or more often between the tumor and its capsule on its inner or median aspect.

It is evident from these anatomical considerations, and was most evident in the case to be reported, that the capsule furnishes a guide of the utmost importance to the surgeon. It would be recognizable by him even in the comparatively flimsy form in which it was present in these normal cadavers, but when it has been subjected for many months to the increasing tension of a growing tumor it becomes, or had become in this case, greatly thickened and was a structure so definite that though it might easily be missed by a careless surgeon, it would be identified with the greatest ease by one who was watching for it.

Upon consideration of the anatomical facts just enumerated, it will be apparent that while upon its upper or peritoneal surface the prerenal fascia is in contact with a most varied

collection of important and vital structures, most complicated in their relations and variable in their positions, the dangers which lie within it are few and are necessarily limited to certain comparatively circumscribed regions. Along the anterior surface of the tumor, but separated from it by the prerenal fascia and therefore entirely outside the perirenal cavity will be seen the descending or ascending colon in accordance as the attack may be made on the left or the right side of the abdomen; but as the vessels supplying the colon come from the median line, the surface of the tumor external to the colon will necessarily be free from any possibility of their presence. The capsule may, therefore, be incised with safety along the outer or lateral aspect of the tumor.

The technique of this incision should be as follows: In this situation,—*i.e.*, external to the colon, many small and comparatively unimportant subperitoneal vessels will be seen to cross the tumor transversely,—*i.e.*, in the direction which would be horizontal if the patient were upright. These will be found to move backward and forward over the surface of the tumor with the peritoneum, gliding backward and forward with it over the surface of the capsule, to which it is but loosely attached. The incision should be carried through the peritoneum only, in a direction parallel to and between these small vessels and without injuring them. They will give no further trouble. Space having been thus gained, and by retraction of the edges of the peritoneal incision a considerable portion of the white glistening capsule (the prerenal fascia) having been exposed to view, a similar incision directly beneath the other may be carried through the capsule with safety so long as it is thus limited to the outer or lateral aspect of the tumor. The yellow glistening perirenal fat will then come into view, but from published descriptions it is probable that the aspect of this fat will vary widely in different cases from the normal appearance of perirenal fat to a smooth, whitish, myxosarcomatous-looking substance.

The hand should next be inserted between the surface of

the fat and the inner surface of the capsule, where a distinct plane of cleavage will be found, and the capsule should be separated from the subjacent fat upwards and downwards for as long a distance as the hand can be made to pass along the outer and lateral aspect of the tumor, where no dangers are to be found. A similar separation of the fat from the capsule towards the median line should be conducted with more care on account of the probable presence of the ureter immediately beneath the capsule in this situation. In the smaller tumors it may be possible by this process of separation alone to carry the finger-tips into contact with the kidney, which will be found in its normal situation at the upper and posterior portion of the tumor, imbedded of course among the fat as a normal kidney is imbedded in the midst of the normal fatty capsule. When this can be done the ureter should at once be traced downward from the kidney and its passage followed throughout its entire length or until it is below the lower pole of the tumor, where it will be lost in the wall of the cavity as the prerenal and retrorenal fascia come together. In the larger masses, such as that which we have to report, the size of the hand and wrist and the great tension induced upon all the contents of the abdomen by the size of the tumor will render it impossible to reach the kidney without grave danger of tearing the colon or other important structures until after a preliminary reduction of the bulk of the tumor has been made, by some process of morcellement and delivery of the fragments through the incision. In this connection it is of the utmost importance to remember that from the position of the ureter and vessels the tumor may usually be morcellated with freedom and safety along its outer border until its bulk has been so far reduced that the further passage of the hand towards the kidney will be easily possible. In the softer tumors this morcellation may be safely and readily accomplished by separating lobules of the fat from the substance of the tumor with the tactile fingers; in the harder and firmer masses, such as ours, the use of an instrument may be necessary, but the dissection should always be

limited, if it is in any way possible, to the plane of separation between lobules and conducted with a remembrance of the possibility of encountering the ureter.

It is probable that the ureter, the only one of the surgical dangers which can by any possibility pass through the substance of the tumor in this region, will always be found attached to the prerenal fascia toward the median portion of the tumor and anterior to the anterior surface of the fat, but since we are not in a position to say positively that it may not have been dissected from the prerenal fascia by the increasing fat and may, therefore, pass to a greater or less extent through the substance of the tumor (though of course between its lobules) it is of advantage that this preliminary morcellation should be confined to the outer or lateral portions of the tumor from which the ureter is most certain to be absent, and that it should be limited as strictly as possible to the amount which is necessary to enable the hand to pass upward along the outer aspect of the tumor until it can reach the kidney and from there trace the ureter downward throughout its entire length by blunt dissection in the connective tissue between lobules. So soon as the ureter has been isolated the whole lower and outer portion of the tumor may be removed by similar morcellation, after separation from the capsule, without hesitation or fear, since all the other structures whose injury can by any possibility be incurred are strictly limited to the median line or to the upper portion of the tumor around the kidney.

When the lower and outer portion of the tumor has been removed the use of retractors to the edge of the incision in the capsule and the greatly decreased tension of the abdominal contents will make it easily possible to deal with the structures about the kidney and the median line by touch or sight. These structures are, in addition to the ureter, the kidney itself, the renal vessels, the aorta and vena cava, and the spermatic or ovarian vessels and both mesenterics during the upper portion of their course, where they necessarily cross the perirenal space and penetrate the new growth which has distended and occu-

pies it. In this region, however, the duodenum and pancreas lie in immediate contact with the perirenal space, though outside the capsule, being separated from it only by the prerenal fascia, and although the fingers of the surgeon within the capsule cannot directly injure these viscera, care and gentleness should be scrupulously observed to prevent traumatizing them.

The position and course of the renal vessels through the fat may be ascertained by following them from the kidney to the great spinal vessels with the fingers, gently separating them from the fat, which is always lobulated, and since the vessels necessarily lie between lobules, the connective tissue which separates the lobules will furnish a plane of cleavage for the free dissection of these vessels, by stroking motions with the fingers.

Since the new growth lies in direct contact with, and separated only by loose connective tissue from, the aorta and vena cava, the spermatic or ovarian vessels, and the superior and inferior mesenterics, great caution and delicate tactile sense must be here used in following the planes of cleavage between the various lobules of fat; but if the great mass of the tumor has been already removed so that tension is absent and the field of operation is readily accessible, this may be done largely by sight, and the intelligent pursuit of these known anatomical dangers should now offer not more than ordinary difficulties to any surgeon of fair operative ability. Its careful performance was in no sense difficult in our case. It must be remembered, however, that all these vessels penetrate the prerenal fascia and leave the cavity of the tumor at but a short distance beyond their origin, and that no attempt to follow them into the fascia and beyond their direct contact with the fat is for a moment to be allowed.

In the very largest tumors it may be necessary after removing one lateral half of the tumor through the incision just described, to abandon it for a moment and begin a fresh attack upon the opposite, outer, and lateral border by a similar incision, and by the same method, for the removal of the other

lateral half of the tumor; but as will be seen in the report of our case, which occupied three-fourths of the abdomen, it will probably be possible in all but the most extremely large tumors to free the renal vessels and ureter of the opposite side and complete the removal of the tumor piece by piece through the one incision.

The controlling factors in the technique throughout the whole operation are then, first, that so long as the fingers of the surgeon are within the perirenal fascia he has only the above-enumerated, definite, and known dangers to deal with; and, second, that these structures must all and always follow, throughout their course, the areolar tissue lying between contiguous lobules of the new growth; so that, in addition to the regional safety already emphasized (the safety of the outer or lateral aspect), the morcellation of the mass, lobule by lobule where this is possible, will greatly lessen the risk of injuring these few and easily-recognized dangerous structures.

To judge both from our own case and from the published accounts of other cases no hæmorrhage will be met with during the operation unless one of these *named* vessels is carelessly or accidentally injured. At some point near the upper end of the tumor one large vessel was found entering the tumor and distributing itself to the fat, but this was easily recognized as such, and was the only vessel tied.

REPORT OF CASE.—Miss N. A., 38 years old, teacher, was sent to us on November 25, 1904, by Dr. Franz Pfaff for the treatment of an abdominal enlargement, her only symptoms being those of neurasthenia and indigestion. A careful cross-examination brought out the following complaints, and these only:

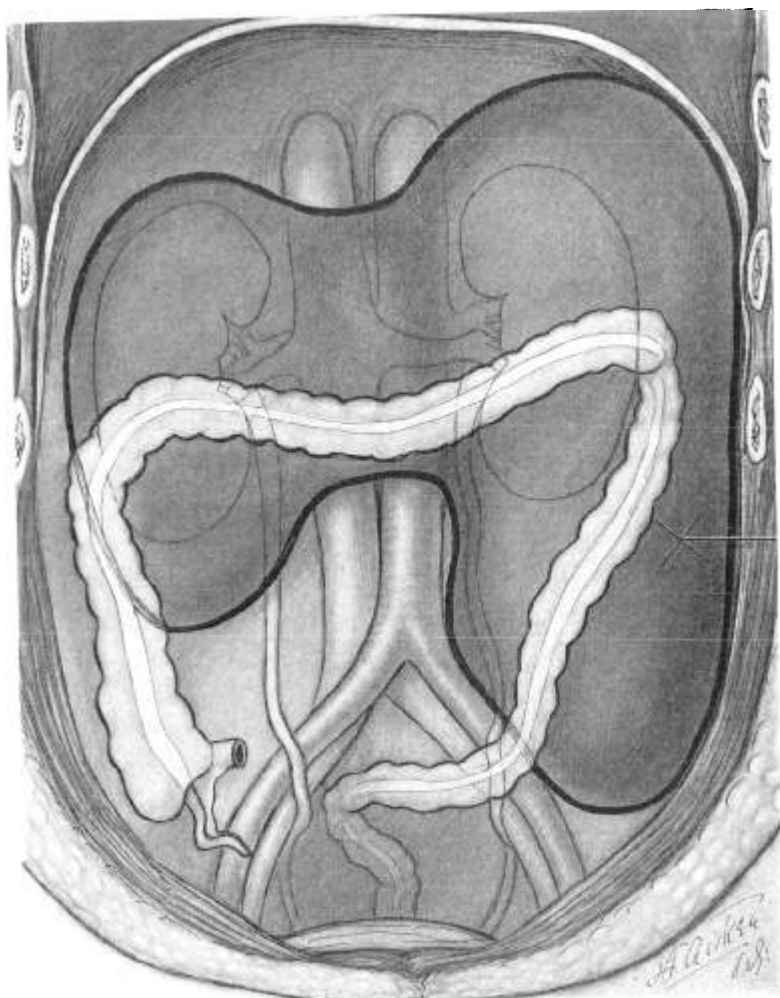
“Bloating” and regurgitation of acid fluid during digestion for nine months; “gas pains” in the epigastrium for one year; sensation of weight in the abdomen for eight months; had noticed an increasing girth for about the same period; catamenia regular and painless; standing and walking had caused some bearing-down sensation ever since puberty, but this had been decreasing lately; bowels moved daily with cascara, urination comfortable

but slightly frequent for some years. Had been neurasthenic from sixteen to twenty-six, and from thirty to thirty-three, both times with digestive symptoms, and was evidently in the same condition again. Family history good; relatives all long lived.

The patient was a very intelligent woman and an accurate witness. She had noticed nothing which differed from her previous attacks of neurasthenia with digestive symptoms, except an increase in the size of the abdomen, which was so uniform that she had not considered it important.

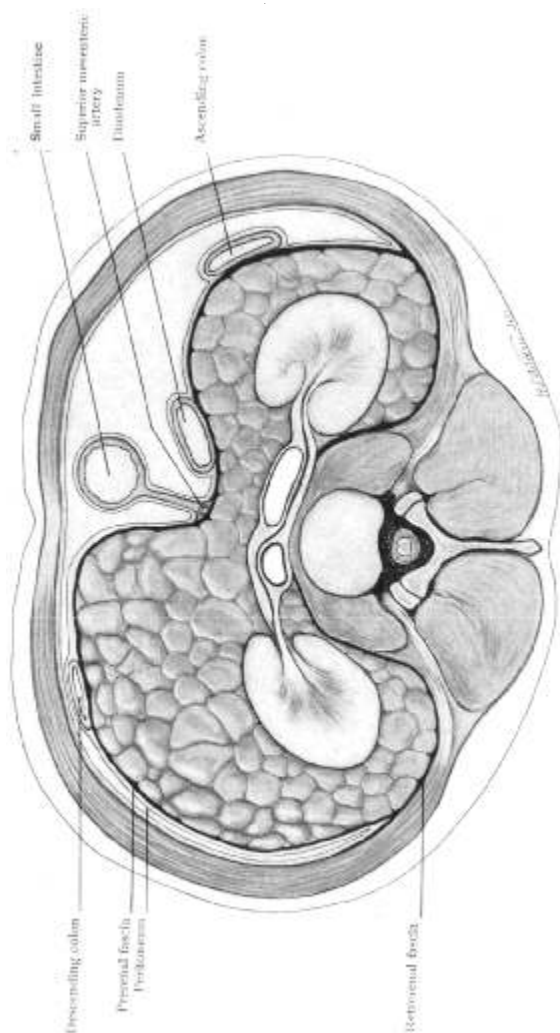
On examination the abdomen was uniformly enlarged and resistant, palpation giving no information. Percussion was dull in the right lower quadrant, and uniformly flat everywhere else, except in the epigastrium, where the tympanitic note was separated from the flat by an almost straight transverse line; change of position made no change in the results of percussion. On vaginal examination nothing was felt except that the uterus was rather far forward behind the pubes, no bulging of the vaginal roof. Under nitrous oxide nothing further was learned except that under strong abdominal pressure the lower surface of a rounded mass was brought within reach of the vaginal finger. It was smooth, elastic, and its under-surface was of about the curvature of the full term foetal head, lying mainly on the left of the median line. The diagnostic summary as written down at the time was: "Large new growth, probably ovarian (too high for an ovarian); malignancy cannot be excluded. Recommended immediate operation."

On opening the abdomen, slightly to the left of the median line and a little below the umbilicus, a large mass presented which was soon seen to be roughly cylindrical in outline, occupying the whole left half of the abdomen, and extending slightly beyond the median line to the right. It ended abruptly by a rounded extremity just above the brim of the pelvis, one of the longitudinal bands of the colon was visible on its surface and it was at first taken to be an enormously distended descending colon. A large soft rubber rectal-tube was passed into the anus by an assistant and guided upward through the sigmoid by the abdominal hand in the hope of passing an obstruction and emptying the tumor; its presence, however, readily demonstrated that the empty and flattened colon lay entirely in front of the tumor.



Region in comparative safety.

Semi-diagrammatic view of the anterior aspect of the tumor, showing the kidneys, ureters, renal vessels, aorta, and vena cava behind, and the colon in front of the tumor. The liver, not shown, was crowded upward and to the right; the small intestine, also not shown, lay wholly in the right lower quadrant.



Semi-diagrammatic cross-section through the tumor at the level of the renal vessels, seen from above. The preperitoneal and retroperitoneal fasciae unite to form the transversalis fascia. The whole intestinal tract lies in front of the preperitoneal fascia.

The incision was now enlarged upward and downward to a total length of about eight inches, and on stretching it apart laterally the peritoneum became visible on either side of the colon, the tumor being evidently retroperitoneal and behind the colon. Over the right or median aspect of the tumor the distended mesenteric vessels were plainly visible, while on the left, or outer, aspect was a very fine tracery of transverse parallel red lines, evidently enlarged and partly filled subperitoneal blood-vessels. This tracery (*i. e.*, the peritoneal and subperitoneal tissues) could be freely moved about over the surface of the tumor. The hand passed through the enlarged incision could now make out that the tumor extended upwards further than the hand could reach and that its upper portion evidently extended into the right side of the abdomen. The peritoneum to the left of the tumor (*i. e.*, external to the colon) being divided by a transverse incision running between the parallel subperitoneal vessels, a tough connective-tissue capsule came into view. The tumor was fluctuant, and the capsule was punctured in the expectation of getting fluid; fat appearing, however, the capsule was divided to the extent of the peritoneal wound, thus admitting the half hand between the capsule and the surface of the fat, which were easily peeled apart by the fingers. By very careful work the whole hand was eventually inserted without injuring the colon and the fat was now separated from the capsule in all directions as far as the hand could reach. The tension within the capsule was, however, so great as to make gentleness difficult and the hand was unable to even approximate the limits of the tumor without the use of an unjustifiable degree of force. The fat in the immediate vicinity of the incision was therefore drawn forcibly out of it and cut off with a knife, and this process of morcellement was alternated with further dissection of the tumor from the capsule by the fingers, until enough working space had been gained to permit of the removal of the whole lower part of the tumor, when the hand readily penetrated to the neighborhood of the left kidney. With the progress of the work it became evident that the tumor was lobulated throughout and the latter part of the morcellement was done wholly by separating lobule from lobule by gentle dissection with the fingers in the lines of cleavage between them. It is probable that this process could

have been adopted from the start and it would certainly have been far safer than the use of the knife.

With the approach to the perirenal region the fat of the tumor gradually assumed the characteristic appearance of the perirenal fat and was separated from the kidney, ureter, and renal vessels by careful dissection with the fingers, the kidney and its appendages finally lying plainly visible in the cavity so formed, and the spleen being evident just above it. The hand was then able to follow the tumor across the median line above the root of the mesentery and to separate it by careful work from the aorta, vena cava, and their branches. On the right side it became continuous with the right perirenal fat which was similarly separated from the kidney, renal vessels, and ureter, the tumor turning around the root of the mesentery and extending downward within a similar capsule to a distance some inches below the lower pole of the kidney. With each successive removal of a portion of the tumor the difficulty of the work decreased progressively and to a remarkable degree until the separation of the right side was attended by surprisingly little difficulty. At about the median line one large artery and vein were seen to enter the tumor and distribute themselves through the fat. They were easily recognized and tied. There was absolutely no hæmorrhage throughout the operation, and these were the only vessels tied. A fibroid about the size of a pea was removed from the fundus uteri. The pelvic organs were otherwise normal. A strip of gauze was placed in the tumor cavity and brought out through the upper end of the abdominal incision. The remainder of the incision was closed with through-and-through silkworm-gut stitches, with a continuous stitch of chromicized catgut to the peritoncum.

The entire mass removed was all that could be piled upon a large china (washstand) basin and weighed nearly fifteen pounds (14 lbs., 14 oz.).

There was a very profuse discharge of bloody serum through the first twenty-four hours and shock was marked, but was never regarded as really alarming. The wick was removed on the second day and thereafter the convalescence, though somewhat slow, was entirely uneventful, the patient sitting in a chair on the twenty-first day and leaving the hospital at the end of four weeks in very good condition. She returned to her work in about

four months, but being still somewhat troubled by neurasthenic indigestion was advised by Dr. Pfaff to take a year's rest. She is otherwise in excellent condition.

Although this operation was successful and although we believe it was conducted along the lines which should lead to a high percentage of success, the method adopted was reached purely by instinct from the necessities of the situation, and the dissection throughout was attended by the greatest anxiety to the operator, but the comprehension of the conditions which we have gained by the anatomical studies upon which this paper is based has made us feel that the attack upon a second case of this nature would be comparatively easy and safe.

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